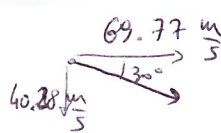


$$1) V_0 = 290 \frac{\text{km}}{\text{h}} = 80.56 \frac{\text{m}}{\text{s}}$$



$$a) \tilde{t} = \frac{d}{V_0 \cos 30^\circ} = 10.03 \text{ s}$$

$$b) y = -\frac{1}{2} g \tilde{t}^2 - V_0 \sin 30^\circ \tilde{t} + h \Rightarrow h = \frac{1}{2} g \tilde{t}^2 + (V_0 \sin 30^\circ) \tilde{t} = 897.5 \text{ m}$$

$$c) V_y(\tilde{t}) = V_{0y} + g \tilde{t} = 40.28 \frac{\text{m}}{\text{s}} + 98.4 \frac{\text{m}}{\text{s}} = 138.7 \frac{\text{m}}{\text{s}}$$

$$\Rightarrow \vec{V} = (69.77 \hat{i} + 138.7 \hat{j}) \frac{\text{m}}{\text{s}} \\ |\vec{V}| = 155.26 \frac{\text{m}}{\text{s}}$$

$$d) \Delta U = 0 - mgh = -88044.8 \text{ J}$$

$$e) \Delta K = 88044.8 \text{ J}$$

2) a) (B)

$$R_x = \frac{mV_B^2}{R} = \frac{m}{R}(V_0^2 - 2gR) \\ R_y = mg$$

(C)

$$R_x = 0 \\ R_y = \frac{mV_C^2}{R} = \frac{m}{R}(V_0^2 - 4gR)$$

$$V_B: \quad \frac{1}{2} mV_0^2 = mgR + \frac{1}{2} mV_B^2$$

$$V_B^2 = V_0^2 - 2gR$$

$$V_C: \quad \frac{1}{2} mV_0^2 = 2mgR + \frac{1}{2} mV_C^2$$

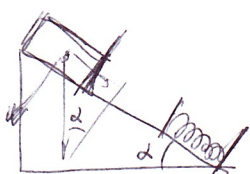
$$V_C^2 = V_0^2 - 4gR$$

$$b) \text{ In (C) } R_y \geq P \Rightarrow \frac{m}{R}(V_0^2 - 4gR) \geq mg$$

$$\Rightarrow V_0^2 \geq 5gR$$

$$V_0 \geq \sqrt{5gR} \approx 8.6 \frac{\text{m}}{\text{s}}$$

3)



$$a) mg \sin \alpha (L + \Delta x) = \frac{1}{2} k \Delta x^2$$

$$k \Delta x^2 - 2mg \sin \alpha \Delta x - 2mg \sin \alpha L = 0$$

$$\Delta x = \frac{mg \sin \alpha + \sqrt{(mg \sin \alpha)^2 + 2mg \sin \alpha L k}}{k} = 98.9 \text{ cm}$$

$$b) mg \sin \alpha (L + \Delta x) - mg \cos \alpha \mu (L + \Delta x) = \frac{1}{2} k \Delta x^2$$

$$\Rightarrow \Delta x \text{ cm } mg \sin \alpha \rightarrow mg (\sin \alpha - \mu \cos \alpha) \Rightarrow 78.3 \text{ cm}$$

$$4) a) F \sin \theta = \mu_d F \cos \theta \Rightarrow$$

$\tan \theta = \mu_d \Rightarrow$ la forza può avere qualsiasi modulo, ma deve essere orientata in $\theta = \arctan \mu_d$

$$b) F \sin \theta \geq F_{A_{\max}} = F \cos \theta \mu_s$$

$$\Rightarrow \sin \theta - \mu_s \cos \theta \geq 0$$

$$\Rightarrow F(\sin \theta - \mu_s \cos \theta) \geq 0$$

$$\Rightarrow \tan \theta \geq \mu_s \Rightarrow \theta \geq \theta_0 \quad \theta_0 = \arctan \mu_s$$